Reliability Assessment of Temporary Structures Using Past Performance Information

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Abstract

Temporary structures are structural systems set up for applications in relatively short time periods for such functions as maintenance, repair or retrofit of a structure or for staged performances. Examples include scaffolds, temporary shelters, temporary walkways, tents, temporary supports, and other facilities used for a limited service time.

Design of temporary structures to dead and live load does not often impose any particular difficulty, however design to seismic or wind load requires a more careful investigation. This is because the service life expected of a temporary structure is much shorter than a "permanent structure," and the probability of extreme load exposure to the temporary structure is substantially less. Thus it will make sense to use a reduced load level proportional to the intended service life of the temporary structure. Using a reduced load level may be a reasonable assumption for a structure that is only used once. However, the decision to allow the same structure to be reused brings about certain ambiguity as to what happens to the level of risk inherent in the structure, which is now subject to repeated use and some reduction in its capacity due to periodic disassembling and reassembling.

This paper provides an overview of risk analysis models for temporary structures (by the lead author and his coworkers). In an attempt to provide a decision-making strategy for repeated usage of a given temporary structure, the performance record of a structure is used in predicting its future condition in the form of a probability of failure. This probability of failure is demonstrated as being a key factor in the decision-making process. To quantify the model, the special case of tube and coupler scaffolds is investigated. Considering stability requirement for a scaffold, gross capacity values are obtained for several configuration types. These capacity values are also important in computing the probability of failure of the systems and decision-making in whether to allow a system to continue with its usage, as explained in the paper.